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The implementation of integrating e-Procurment, e-Contracting and e-Invoice platforms for the B2B E-MarketPlace web-based system

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Abstract—Corporations encounter several challenges when they adopt global logistic system in their producing and selling model. One of the most common concerns is how to efficiently share information among members in supply chain. The key solution for this problem is to ensure the accuracy of the purchasing, trading and supply data and to be able to integrate them.

Nowadays, business competition has became more globally and been reaching its climax. The development of information technology and management techniques is also in a tremendous pace. Under the circumstances, business are provided as many opportunities as they have never seen before, but at the same time, they also face unprecedented challenges. In order to be more competitive, corporations must not only be able to coordinate with upstream providers, but also have to adequately allocate their internal resources.

In the development of B2B market, Supply Chain Management (SCM), Enterprise Resource Planning (ERP) and E-Commerce have been hot topics for a long time. However, there are some issues deserve researchers making more efforts and discussion as well. How to integrate supply chain system among corporations to obtain low inventory and automatic trade is one of them. Obviously, only when E-MarketPlace is structured and integrated with internal ERP, combining with resources from upstream providers and partners, companies can really benefit from resource sharing and enter into B2B or B2C E-Commerce system.

This system is designed and implemented from techniques associated with Java, creating an B2B E-MarketPlace platform and applying it for cross-industries purpose. From petrochemical raw materials, plastic, textile, electronic material, machinery, power generation, education to bio-chemistry, information and environmental technology, including 3,000s different industries, more than 13,000 suppliers, 9300 vendors and 7700 e-invoice members share this platform. Users can choose to operate through platform functions as they need or combine with partners' ERP through data exchange to create low cost and rapid match which are beneficial to the companies. Moreover, current users also can take advantages from the E-MarketPlace mechanism to reinforce their information system.

Keywords: B2B; E-MarketPlace; E-Purchasing and management system for supply chain; E-Contracting; E-Invoice; Java.

I. INTRODUCTION

According to Aberdeen Group's survey, the competence of integrating activities within supply chain defines a company's competitive advantages. If any corporations intend to reach a breakthrough in business partner integration, the only way to achieve that objective is to adopt a full automated trading system for purchasing and selling in the internal supply chain, as well as between buyers and sellers of external trading participants [5], [6], [7]. Due to increasing competitive pressure and shortening product life cycle, the development of value chain which used to be slow and stable has transformed into an active and fast responding system. In order to be considered as successful, companies should be able to effectively reduce costs to ensure efficiency and profit, continuously improve quality and service, and keep good relation with up-stream, down-stream customers and partners [1].

A new business model, E-MaketPlace, has formed recently as cyber information technology grows day by day. The mechanism of E-MarketPlace is to create a high efficiency environment for companies to do business. The high efficiency environment refers to a platform where not only buyers and suppliers can meet one another's need with lower cost, potential customers can also have more opportunities to contact or build up relations with possible partners. Gradually, the competitiveness of whole supply chain will be enhanced and most of the companies will be able to keep their leading position in global competition [2].

Unfortunately, most of current e-marketplaces don't provide any solutions as integrated platforms need. According to Morgan Stanley's report, only 5% of e-marketplace is able to do portion of resource planning and system coordination for buyers and suppliers. As a matter of fact, what many of them can do are just email purchase orders to suppliers. Then, suppliers key in the

data into their resource planning software manually, process with their production scheduling and inventory data management system afterward [3].

The purpose of this system is to design an e-marketplace to integrate e-procurement system, e-contracting system, as well as e-invoice system. The objectives and efficiencies this system has achieved are as follows:

1. Use e-Seal and encryption technology to keep the authenticity, completeness and undeniableness of all data.
2. Expand current inquiry scale, utilize market mechanism to reduce purchasing cost.
3. Make sure bidding information is digitalized, open and transparent so that collusive tendering can be completely prevented.
4. Attract more potential customers.
5. Update online catalogue instantly.
6. Provide open and transparent trading model.
7. Build a "many-to-many" service structure. In addition to current companies, establish more commerce relationship through the open trading platform.
8. Organize complete and transparent supply chain data to improve processing efficiency and reduce trading cost.
9. Integrate with current ERP system.
10. Reduce management cost and expenditure.

II. RESEARCH REVIEW AND RELATED WORK

A. E-MarketPlace

Legg Mason, an investment counsel and asset management firm defines B2B online market as the electronic version of traditional market where the buyers and vendors can do business together. Deloitte Consulting describes online market as a place where demand and supply follow certain mechanism and regulation to accomplish money, invisible products and services exchange or to collect more valuable information with specific product range. Kaplan (2000) [4] believes e-MarketPlace is a platform that gathers many buyers and vendors and helps them to find partners to do business through an automatic matching and transaction system. Within the marketplace, buyers will have plenty of options in products and services. At the same time, vendors will be able to find new customers and new markets so that cost can be cut in both sides. The convenience of internet provides a variety of information which helps enterprises break the limitation they used to have due to lack of sufficient data (John, 2001) [17]. According to Gartner Group, digital market is a website which helps purchasers and sellers to get more extra values is also called B2B Patrol Site, Trading Hubs or Electronic Exchange.

The Economist (2000) [18] analyzed the three models of online market in terms of the role of administrator and participant. First, in order to cut cost, one leading company of an industry uses internet to connect its own suppliers and distributors to either purchase material or sell products online. Second, a third party hosts an independent digital market which is also named as Electronic Market. The independent company helps buyers and sellers to contact one another through internet and this model has more potential than the first one. The third one is the market built by several leading companies of an industry which is called Industry Platform as well. The electronic market mentioned above can be divided into three types: e-Procurement hosted by buyers, E-Distribution hosts by sellers, and the e-MarketPlace hosted by a third party. All of them have several successful cases introduced as follows:

1. E-Procurement hosted by buyers: The most significant strength of this type is that it is easier for buyers to get lower product pricing as sellers bidding to win the deal. For example, Formosa Plastic established an e-Procurement system in January 2001. 90% of the company's construction contracts and bids were held through internet since then and suppliers were all required to complete online bidding application. This system enhances relations among suppliers, distributors and customers, and also promotes the efficiency and transparency of purchasing operation.

2. E-Distribution hosted by sellers: Sellers can provide better services to all customers and to meet their needs. For instance, Office Depot of United States (http://www.officedepot.com) was funded as a catalog merchant and has transformed into a global enterprise of office supply. Now, Office Depot uses existing call center and more than 2000 trucks to handle orders and deliver catalog merchandise to customers. It goes from real stores into virtual world. Online stores save the company mail and catalog print expenses. While images and specifications of products still can be viewed on the website. Customers shop online instead of by phone or fax. And the total cost is estimated to be cut in half.

3. E-MarketPlace hosted by the third party: The major advantage of e-MarketPlace is finding a match for buyers and sellers within certain product category. Alibaba (http://china.alibaba.com), the best-known B2B e-MarketPlace funded in China in 1998, is a good example for this type. It establishes an information platform for small and medium business and that solves the biggest problem in Chinese market due to lack of complete logistic and distribution system. The platform also helps international purchasers search for products and manufacturers in an open and transparent environment. Obviously, the operation efficiency of the whole market was uplifted because of Alibaba.

IDC, an American market research, analysis and advisory firm, also defines e-Commerce with three major categories: E-Distribution directed by sellers, e-Procurement controlled by buyers and e-MarketPlace hosted by the third party. According to IDC, the B2B online marketplace is a service provider from

a neutral third party while none of buyers and sellers can control the market operation alone.

B. E-Invoice in Other Countries or Areas

Invoice was originally defined as commercial trading certificate. In many countries, companies are authorized to issue and print invoice to prove deals are completed. In Taiwan, government creates a very special taxation tool called The Uniform Invoice. Business entities must issue Government Uniform Invoice (GUI) to the buyers at the time of purchase and receiving payment. Companies have to show the duplicate of GUI when filing tax. It serves as the certificate of business transaction, accounting and taxation. As e-commerce is booming globally, many developed countries have already adopted e-invoice to eliminate obstacles and reduce costs that used to have when using traditional paper invoice.

The so called “e-invoice” is issued, transmitted, and received from internet or other electronic paths. There are three types of e-invoice in terms of the participants of e-commerce. B2B is business to business. B2G refers to business to government and B2C is for business and customers. So far, Northern Europe countries including Finland and Denmark are among the leading economies of using e-invoice with most mature regulation and system. Recently, European Union (EU) is working on the amendment of Digital Signature Act to design a united law to regulate the usage of e-invoice within the area. The ultimate goal is to build up a common system that the e-invoice can be applied, accepted, and recognized among all the members in EU. Hopefully, it will be an incentive for small business to use electronic invoice. According to Chih-Hao Hsu (2007) [20] and Wikipedia’s survey, current development of e-invoice in EU, Finland, Sweden, Denmark, Belgium, Chile and Taiwan are highlighted as follows:

1. European Union

After new e-invoice regulation of EU is effective, business can freely choose the most favorable methods. They are either an automatic processing IT system within companies (similar to the seller-buyer value-added center in Taiwan) or the invoice services from authorized providers (similar to the value-added service center from an independent third party in Taiwan). The latest policy gives enterprises more freedom and options in using e-invoice. Currently, European Commission allows countries to decide whether companies need to inform local taxation offices before using e-invoice. Otherwise, companies only have to complete an initial registration, and the evaluation from taxation offices are not required.

2. Finland

The e-invoice system in Finland is promoted by Finnish E-Invoice Forum, set up by Finnish Information Society Center, TIEKE. It has been almost 20 years since e-invoice system first adopted there. During these years, Finnish government’s complete open policy creates an environment that all private e-invoice platforms can be both competitive and cooperative, truly shows the spirit of free economy. IT service company, Elma, sets up an e-invoice platform for all public sectors to receive B2G e-invoice in Finland. Therefore, suppliers working with government are always asked to act accordingly. In the other side, there is also a program for ordinary customers that they can get personal e-invoice through e-banking. Nowadays, the top 500 enterprises in Finland have adopted B2B e-invoice system.

3. Sweden

May 2003, Swedish government established a joint initiative, SFTI (Single face to Industry) to promote B2G e-commerce system. And the organization started to come into operation in June 2004. Since then, the B2B and B2C e-payment/e-invoice systems have been gradually developed by e-banking institutions as well.

4. Denmark

Denmark is one of the leading countries in e-invoice application in Northern Europe. Since February 2005, up to 95% of business adopts B2G e-invoice. To set this policy into action, Danish government first designed the e-invoice message implementation guideline, and then developed a B2G entrance website so that companies can issue e-invoice to public sector through there. Free invoicing platform, Tradeshift (http://tradeshift.com), established by the system developers for Danish government, has near 50,000 clients around the world including British National Health Service, the government of Ireland and France.

5. Belgium

The Administration of the Treasury in Belgium started using e-invoice in 1997. Nine companies are authorized to issue e-invoice and Isabel with 41,000 clients is the biggest service provider among them all. It also works with e-banking institutions to issue personal e-invoice to customers.

6. Chile

In 2003, Chile began its test operation of e-invoice and the system was not promoted in full scale until next year. Companies used to have to bring all the blank document to local taxation office to apply for using e-invoice. And now, they can get a range of invoice numbers from government online service and use client tool to issue e-invoice. All the related information will be directly uploaded to the database of National Taxation Office.

7. Taiwan

The Ministry of Finance published the [Test Operation Guideline For Online Uniform Invoice] in November 2000, and started in action in the following month. To encourage business using e-invoice, the Ministry of Finance also established [Promotion Project of E-Invoice] in 2004 and B2B, B2C E-Invoice Integrated Platform service in 2006 (http://www.einvoice.nat.gov.tw). It is a free service with functions of invoice certification, tax service, data exchange and statistic analysis. It also provides many other integrated and paperless services. Currently, the platform has processed nearly 1.55 billion invoice from more than 30,000 companies, with more than 80 clients as members of buyers/sellers value-

added service center and the third party value-added service center.

This research focuses on B2B e-invoice and the following is a more detail explanation for the practical application of the three models of B2B invoice (Institute for Information Industry, Taiwan, 2007) [21].

1. Buyers' value-added center: The main business here is purchasing, ordering , and shipping as well as issuing, transmitting and receiving e-invoice. It should include a complete e-procurement system which needs to be able to connect upstream and downstream vendors to form an integrated supply chain and to enhance its competitive advantage.

2. Sellers' value-added center: Companies sell products and services. What they need is an e-invoice transmitting system that invoice can be sent to buyers as well as saved for internal record. The system digitalizes companies operation data, streamlines production and sales procedures, and helps reduce the cost of data processing and storage.

3. Independent third party value-added center: Corporations that are capable of providing information service can design an e-invoice transmitting program. Companies access to the system sending e-invoice to customers, downloading and printing copies for themselves. At the same time, customers can also print out the receipt of e-invoice or a copy for tax deduction through the system.

Case study shows time and cost-saving are the direct benefits coming from using e-invoice. According to Celent Communications LLC, an international financial research and consulting firm, sellers save up to USD$15 per invoice while buyers save USD$6~$10 per invoice by using digital ones.

Statistic indicates Taiwanese companies uses 8 billion paper-based invoice a year. However, if they switch to e-invoice, the whole country can save up to NTD$2 billions (USD$ 66 millions) every year. Which is a huge incentive for e-commerce development (Ya-Ting Hsu, 2007) [22]. Undoubtedly digitalization can be both convenient and eco-friendly ways to do business.

C. Our Definition of the B2B E-MarketPlace

Consolidating all the research reviews and analyses, here is the new definition of online MarketPlace: B2B e-MarketPlace is a trading platform based on computer network. It provides an area where all the members exchange products and services with one another under the protection of e-Seal and encryption. This is also an internet location without geographical boundary or time limit, members interact through one-to-many or many-to-many networks meeting matches to do business.

III. OBJECTIVES OF SYSTEM DEVELOPMENT

Electronic marketplaces are an important research theme on the information systems landscape [19]. According to transformation of traditional business, establishing company websites is the most direct breakthrough in transforming businesses from traditional style into the state-of-the-art e-commerce. The websites serve as windows for companies to touch global market and promote their own images as well as products. With abundant resources and strong brands, traditional companies can easily use online marketing and instant interactive function to develop new ways of doing business and build up direct channels of sales through e-commerce.

In the business world of 21st century, companies face more aggressive competition and shorter product development cycle. Moreover, they are asked to provide high quality products and fast service with low price. In order to meet market trend and customer expectation, companies have to use information technology to integrate internal data and coordinate operating process. Considering the advantages of division of labor, outsourcing portions of business functions will help companies focus on their specialties and perform well in their core competences.

Internet development changes traditional business to business (B2B) trading style and forms a so-called "internet economy" which revolutionizes the old-fashioned business environment and operating structure. Partners used to interact through electronic data exchange, but now, they are able to cooperate in operating process and share mutual benefits and wisdom. The private supply chain management system which was originally for internal use only are now transformed into an open and advanced internet business platform—e-MarketPlace. It bases on the up-stream and down-stream supply chain management systems within industries, providing resolutions and services including B2B e-MarketPlace, e-invoice center and purchase order management system. Eventually, it aims to create a superb trading environment and help the whole industry achieving its supply chain competitiveness.

For buyers (purchasers), the main function module of this B2B e-MarketPlace is from issuing inquiry notification to managing payment after completing orders. On the other hand, sellers (suppliers) provide an offer and do the price negotiation after receiving inquiry notification. When they win the bid, they can arrange either complete delivery or partial delivery. After the deals are completed, sellers would be evaluated by the system regarding the performance as an approval to offer and to expand their offering range in the future. The concept diagram of the e-MarketPlace is shown as Figure 1.

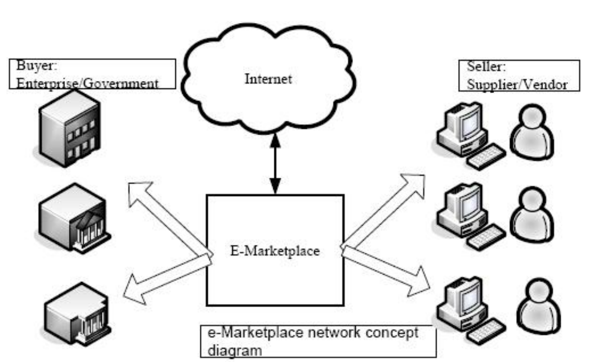


Figure 1: concept of the B2B e-MarketPlace

IV. Web-Based Server Techniques

A. ASP (Active Server Pages)

Active Server Pages [8], [16] is a Microsoft promoted technology to enables HTML pages to be dynamic and interactive by embedding scripts, i.e. either VB Script or Jscript, Microsoft's alternative of Java Script. Since the scripts in ASP pages (.asp) are processed by the server, any browser can work with ASP pages regardless of its support for the scripting language used therein.

Introduced by Microsoft in the mid-1990s, this is the standard programming system for Internet applications hosted on Windows servers. It is bundled with Internet Information Server (IIS) when you buy Windows. The fundamental idea is that you write HTML pages with little embedded bits of Visual Basic, C# or other languages, that are interpreted by the server.

ASP is a compile-free application environment in which you can combine HTML pages scripts, and ActiveX(DCOM, COM+) server components to create powerful Web-based business solutions. Active Server Pages enables server-side scripting for IIS with native support for both VBScript and Jscript.

B. PHP (Hypertext Preprocessor)

PHP was created in 1994 by Rasmus Lerdorf. Self-referentially short for PHP [9], [16] is Hypertext Preprocessor, an open source, server-side, HTML embedded scripting language used to create dynamic Web pages. In an HTML document, PHP script (similar syntax to that of Perl or C) is enclosed within special PHP tags. Because PHP is executed on the server, the client cannot view the PHP code. It also can perform any task that any CGI program can do, but its strength lies in its compatibility with many types of databases. Also, PHP can talk across networks using IMAP, SNMP, POP3, or HTTP.

PHP is a open-source, server-side HTML embedded scripting language used to create dynamic Web pages. A dynamic Web page is a page that interacts with the user, so that each user visiting the page sees customized information. It is freely available and used primarily on Linux (UNIX) Web servers, and as an alternative to Microsoft's Active Server Pages (ASP) technology. As with ASP, the PHP script is embedded within a Web page along with its HTML. Before the page resolves, the Web server calls PHP to interpret and perform the operations called for in the PHP script. An HTML page with PHP script is typically given a file name suffix of ".php", ".php4" or ".phtml". PHP lets you create dynamic web pages that can display a variety of data, depending on what the viewer choses to click on.

A scripting language for writing short programs embedded in a web page. Unlike Java Script, PHP commands are executed on the web server, making it browser independent. The web browser only sees the resulting HTML output of the PHP code. It can be used to create Internet-based applications with numerous uses, including e-commerce.

C. JSP (Java Server Pages)

A scripting language based on Java [10], [16] for developing dynamic Web pages and web sites, Java server Pages are normal HTML with Java code pieces embedded in them. A JSP compiler is used to generate Servlets from the JSP page. JSP allows web pages to be generated dynamically using a combination of XML tags and Java Servlets. Java Server Pages are web-pages and produced by Sun Microsystems. Technology that facilitates the development of dynamic Web pages and Web applications that use existing components, such as JavaBeans, Enterprise JavaBeans(EJB) and Web Objects components. This is one of the technology created to enable development of platform-independent web-based applications.

JSPs have dynamic scripting capability that works in tandem with HTML code, separating the page logic from the static elements the actual design and display of the page. Embedded in the HTML page, the Java source code and its extensions help make the HTML more functional, being used in dynamic database queries, for example. JSPs are not restricted to any specific platform or server. JSP is an extension to Java Servlets allowing the dynamic generation of web pages. JSP is a technology that enables the mixing of regular static web pages (HTML) with content generated dynamically by Java Servlets. JSP can be used with Solaris and Linux(Unix) platforms.

V. E-MarketPlace Implementation and Techniques

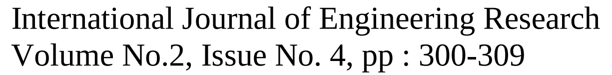
A. e-MarketPlace function modules

The business model for this e-MarketPlace is based on Active Service Providers (ASP) and the main function modules of this system are shown as table 1. More detail operation procedures are as follows:

1. Formosa Technologies Corp. (FTC) is responsible for system maintenance, clients daily data exchange and bidding management.
2. Members training program is provided by FTC.
3. FTC is in charge of upgrading system regularly.
4. Clients have options to work as public (finding a match from all suppliers in MarketPlace) or private (finding a match from its own existing suppliers) models.

All the suppliers or vendors involving in this e-MarketPlace are required to receive inquiries and complete offers online. The procurement and construction contracting systems are 100% automatic matching. In other words, there is no manual handling involved in. A neutral third party is in charge of all the online inquiry, offer and negotiation through digital signature and encryption technologies. Under SSL3 and PKI structures, the privacy, security and undeniableness of transactions are carefully guarded, trading procedures and e-documents are also protected from being illegally leaked out or altered.

This system is developed by using JAVA technology. Oracle Solaris is adopted as Operating System Platform and



IBM WebSphere is as Application Server. All information from buyers, purchasers, contractees and data exchange within the e-MarketPlace are based on XML format under Microsoft BizTalk Server. The e-MarketPlace network data exchange architecture is shown as Figure 4.

B. Implementation Techniques - MVC (Model-View-Controller) Design Pattern

Model View Controller has been widely adapted as an architecture for World Wide Web applications in all major programming languages. Several commercial and noncommercial application frameworks have been created that enforce the pattern. These frameworks vary in their interpretations, mainly in the way that the MVC responsibilities are divided between the client and server [11]. The MVC paradigm is a way of breaking an application, or even just a piece of an application's interface, into three parts: the model, the view, and the controller. MVC was originally developed to map the traditional input, processing, output roles into the GUI realm [12]: Input (Controller)→Processing (Model)→Output (View). In the Java language the MVC Design Pattern is described as having the following components: 1. An application model with its data representation and business logic. 2. Views that provide data presentation and user input. 3. Controller to dispatch requests and control flow. The purpose of the MVC pattern is to separate the model from the view so that changes to the view can be implemented, or even additional views created, without having to refactor the model. The basic MVC relationship is shown as Figure 2.

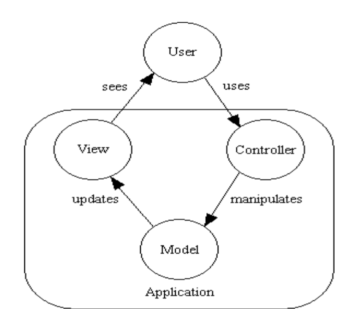


Figure 2: The basic MVC relationship

C. Implementation Techniques - The 3-Tier Architecture

Three-tier architecture is a client-server architecture in which the user interface, functional process logic ("business rules"), computer data storage and data access are developed and maintained as independent modules, most often on separate platforms [13]. It was developed by John J. Donovan in Open Environment Corporation (OEC). The three-tier model is a software architecture pattern. It has the following three tiers [14].

1. Presentation tier: This is the topmost level of the application. The presentation tier displays information related to such services as browsing merchandise, purchasing and shopping cart contents. It communicates with other tiers by outputting results to the browser/client tier and all other tiers in the network.

2. Application tier (business logic, logic tier, data access tier, or middle tier): The logical tier is pulled out from the presentation tier and, as its own layer, it controls an application's functionality by performing detailed processing.

3. Data tier: This tier consists of database servers. Here information is stored and retrieved. This tier keeps data neutral and independent from application servers or business logic. Giving data its own tier also improves scalability and performance. An overview of the three-tier application is shown as Figure 3 captured from WIKIPEDIA.

D. Which one solution to select

Currently, the most popular scripting languages are ASP(Active Server Pages), and PHP(Hypertext Preprocessor), and JSP(Java Server Pages). They all have quite a few supporters for their different strengths. Although they are all for Web server, JSP is more likely to become a hit of the future among these three. JSP/Servlet is used by some leading e-commerce suppliers, IBM, is one of the leading brands, using WebSphere [15] as the core of its e-business. Table 2 shows three possible solutions of the 3-tier architecture after we were familiar with these three and had more experience about all kinds of system softwares implementation. It is also a chart concludes better solutions for enterprises and companies B2B, B2C e-commerce systems. Table 3 shows that we summarized these techniques listing of implementing this B2B e-MarkPlace web-based system. The e-MarketPlace is implemented and its network system architecture is shown as Figure 5.

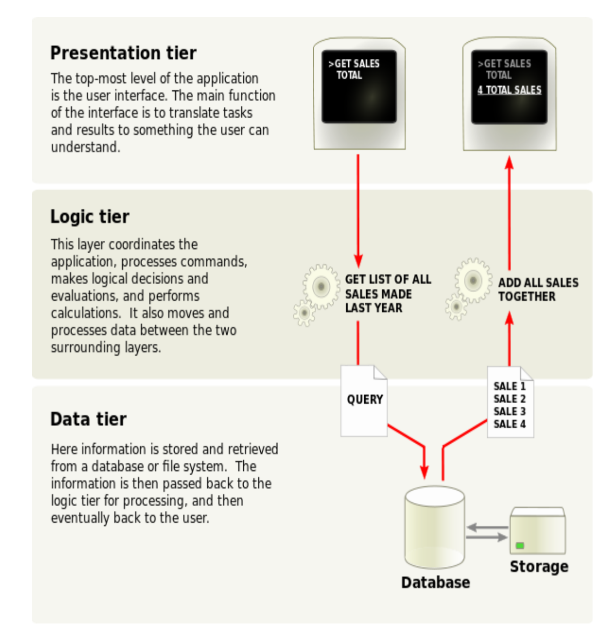


Figure 3: Overview of the three-tier application captured from WIKIPEDIA

Table 1: the B2B e-MarketPlace function modules

System Function	For suppliers	For purchasers
Enterprise procurement	1.Purchasing reports publication 2.Bids Picking and submission 3.Purchase order management 4.Delivery management 5.Document expediting 6.Loan inquiry 7.Delivery note printing	1.Bulletin management 2.Data maintenance 3.Procurement tendering 4.Purchasing management 5.Vendors management 6.Cases review 7.Cases inquiry
System Function	For contractors	For contractees
Construction contract	1.Contract reports publication 2.Construction payment inquiry 3.Bids picking and submission 4.Payment management 5.Progress tracking 6.Enter/exit factory application 7.Material management	1.Bulletin management 2.Data maintenance 3.Contracting and bidding 4.Order management 5.Vendors management 6.Cases review 7.Cases inquiry
System Function	For sellers	For buyers
E-invoice	1.Basic data maintenance 2.Invoice issuing 3.Invoice printing 4.Tax filing	1.Return and rebate 2.Invoice printing 3.Tax filing 4.Void invoice confirmation

Table 2: three possible solutions of the 3-tier architecture

	Kernel Program	Web Program	Data Base	Ap. Server	O.S. Platform	Cross Platform
1	C++/C# /DCOM	ASP/ ASPX	SQL Server	IIS	Window	NO
2	C++/C	PHP	My-SQL	Apache	Window /Linux /Unix	Yes- No MFC[a]
3	JavaBean /EJB[b]	JSP	Oracle	Tomcat /WAS[c]	Window /Solaris /Unix	Yes

a. MFC: Microsoft Foundation Class Library, MFC was introduced in 1992 with Microsoft's *C/C++ 7.0* compiler.
b. EJB: Enterprise JavaBeans was originally developed in 1997 by IBM.
c. WAS: WebSphere Application Server is the IBM Application Server software.

VI. RESULT AND BENEFIT ANALYSIS

Generally speaking, the advantages and benefits of this e-MarketPlace are as follows:

A. E-Procurement

1. Providing functions including quotation, tendering, negotiation, shipping and ordering management, payment and inquiry.
2. Precisely calculating inventory and material supply among up-stream and down-stream vendors.
3. Providing quick response and feedback between suppliers and buyers and helping companies to establish a complete supply chain system.

B. E-Contracting

1. Rapidly transmitting construction bidding information, and ensuring the process is transparent, open and digitalized.
2. Saving handling time and costs by sending construction drawings through internet instead of printing and mailing them out.
3. Preventing tendering process from corruption as well as improving the quality of construction.

C. E-Invoice

1. Integrating e-Invoicing, purchasing, financing and operating to save manual handling expenses.
2. Improving connections and relations among different divisions to enhance internal response speed and operating efficiency.

D. Other invisible benefits

1. Completeness: automatically processing inquiries, purchase, delivery and payment. Saving time and money as well as being able to receive the latest purchase information.
2. Customization: designing a variety of transaction mechanism and content in e-store to accommodate to customers' needs.
3. Integration: connecting with back end ERP system to check data accuracy through interface exchange.
4. Immediateness: sending out inquiry and quotation instantly and emailing notification to buyers and sellers so that they can follow schedule to complete transaction online.
5. Rigorousness: allowing suppliers to join the e-MarketPlace they belong to and offer quotations online after evaluation and approval.
6. Security: Using electronic certificates to protect both suppliers and buyers throughout inquiry, quotation and negotiation process; adopting network encryption to ensure the safety and privacy of transaction data.
7. Expanding distribution channels: structuring e-catalogue and displaying it to help suppliers and buyers to exchange product information, increase opportunities to sell their products and connect with more potential customers.
8. Expanding vendor base: publishing purchase report and holding public bidding to invite more suppliers to participate in the process to ensure the fairness of procurement costs.

E. visible benefits

1. Share all members information from both buyers and sellers, and the one month quantities of member and case in FTC B2B E-MarketPlace shown as Table 4.
2. Members in the MarketPlace are qualified to apply for Purchase Order Financing from 7 banks working with

Formosa Plastics Group. However, banks make final decision according to clients payment and credit records.

3. Save up to 60% of personnel cost for purchase and contract centers.
4. Reduce invoice related cost (issuing, printing, mailing, storage, etc.)

VII. CONCLUSION AND FUTURE WORK

E-MarketPlace connects supply chain and demand chain and serves as a mutual platform to improve resource allocation among companies and to promote the efficiency of transactions. The primary advantages of doing business through e-MarketPlace includes decreasing handling cost, increasing sales revenue, updating product information and saving product development time.

Moreover, e-MarketPlace simplifies purchasing management and construction contracting system. It not only saves numerous money and time which traditionally cost from manual handling, effectively reduces the cost of purchasing and contracting, but also ensures the safety and transparency of online tendering. Focusing on industry supply chain management, companies with e-commerce solutions and services such as B2B e-MarketPlace, e-invoice center, customer purchase order management system, etc. will be able to create a high quality business environment and that will definitely enhance the competitiveness of entire industry.

Finally, there are two suggestions for further improvement of e-MarketPlace and e-Commerce systems:

1. Prevalence of Intelligent Agents: An Intelligent Agent can be referred to a software that follows the settings by designers or users to automatically implement some repeated work, act as a reminder or integrate complicated data. For an intelligent agent never shows difficult details while processing instructions, it's easier for novices to catch up and can be applied in repeated and more difficult work, e.g., merchandise purchasing.

2. Innovation of Profit Model: There are more and more new comers joining e-commerce markets and they are trying to create new operation models. For example, the era of Web 2.0 [23] is one of the hottest topics nowadays. The spirit of Web 2.0 [24]: As long as your products or services are attractive enough, there are always people who are willing to buy them. This new profit model uplifts social websites that used to be ignored in e-commerce becomes spotlights in all kinds of online media.

Figure 4: the B2B e-Marketplace network data exchange architecture.

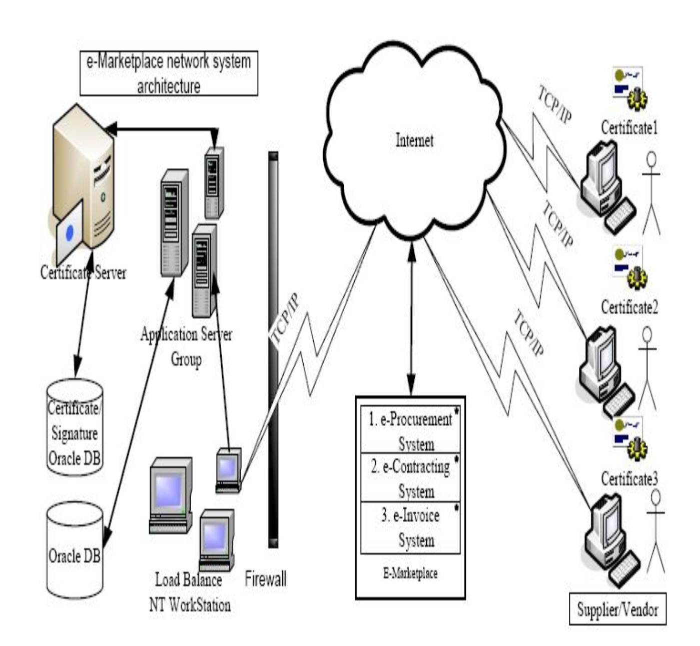


Figure 5: the B2B e-Marketplace network system architecture

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Table 3: The techniques listing of implementing the B2B E-MarketPlace web-based system

	Techniques Listing	Manu-facturer	Product name (Year) /Techniques/skills	Program Languages /Services	Embedded (Default) Specifications
1	Developer softwares and tools	Microsoft Oracle IBM IBM	Microsoft Visual Studio (2005/2008/2010) Oracle JDeveloper 10.1(2007) IBM WSAD[a] 5.1.2(2004) IBM RAD[a] 7.0.0.8(2008)	Visual C#, Visual Ba-sic. Java Bean, SQL, JDBC. Java, JSP, EJB, Html.	.NET frame-work 2.0, 3.0, 3.5, 4.0. JDK 1.5 JSP 1.2, Servlet 2.3, JDK 1.4.1 /1.4.2, WTE[a] 5.1, WAS[a] 5.1, EJB [a] 2.0.
2	Programm-ing techniques and skills	US	Java, .NET, SQL, PL/SQL, Shell Script, Ajax, Html, JavaScript, jQuery	Java, C#, VB, SQL, PL/SQL, JavaScript, Shell Script.	N/A
3	Database tools and skills	Quest[b] Quest IBM Oracle	TOAD for Oracle 8.6(2005) SQL Navigator 4.4(2005) AS/400 iSeries Navigator V5R4(2005) Oracle SQL *Plus 8.1.7(2000), 9.2(2002), 10.2(2005)	SQL, PL/SQL, Functions, Procedures, Packages, Snapshots, Triggers, Java Import etc.	PL/SQL Debugger SQL Tuning
4	Encryption technology	Trade-Van[c]	PKI[c] e-Seal system, SSL3, Digital Sig-nature	Built in library for Java Inter-face use	N/A
5	Framework used	Sun[b] Apache Microsoft	J2EE 1.4, 3-tier, Struts(MVC[d]), .NET	Java, JSP, EJB, Html. C#, VB.	Default (J2EE 1.3/1.4)
6	Application server	IBM	WAS[a] 5.1(2004), WAS 6.0(2004), WAS 6.1(2006)	HTTP, JMS, HTTPS, RMI, JAAS, SOAP, Java2 Security, JDBC.	Default
7	Data exchange requirement	Microsoft EditML Tech.	Microsoft BizTalk Server 3.0(2004) EditML 1.0(1999) or later	Queues, XML	Default, XML 1.0 or later
8	O.S. platform	Oracle	Solaris 8(2000) or later	Network setup and configure	Default
9	Java reference	Eclipse	Eclipse.org (2001-2013)	Free and open-source software	Default
10	Hardware spec.	Sun RISC[a]	SPARC[a]-based: Sun 4 (UltraSPARC II V9)(2000-2002) or later	Built in default or upgrade	Default or upgrade

a: WSAD(WebSphere Studio Application Developer), RAD(Rational Application Developer), WAS(WebSphere Application Server), WTE(WebSphere Test Environment), EJB(Enterprise JavaBeans), SPARC(Scalable Processor ARChitecture), RISC(Reduced instruction set computing).
b: Sun Microsystems was acquired by Oracle Corporation in 2010. Quest Software was acquired by Dell inc. in 2012.
c: The partner Trade-Van is authenticated by Taiwan Network PKI Certificate. (http://www.itradevan.com), PKI(Public key infrastructure)
d: MVC(Model-View-Controller).

Table 4: Quantities of member and case in Formosa Technologies Corp. B2B E-MarketPlace (June/9/2013- July/9/2013)

Date	Suppliers	Vendors	E-Invoice members	Purchase cases	Contract-ing cases	E-Invoice Quantities	Bidding cases
6/9	13566	9339	7675	12311	2111	55	175
6/10	13571	9340	7675	12307	1843	188	185
6/11	13579	9341	7675	12374	1890	205	205
6/12	13582	9341	7675	11482	2174	214	192
6/13	13595	9343	7676	10817	1842	178	205
6/14	13611	9346	7676	11567	1797	132	230
6/15	13695	9350	7676	11509	2198	227	204
6/16	13616	9350	7676	11184	2206	105	196
6/17	13619	9353	7676	11186	1871	85	218
6/18	13626	9355	7677	12138	1928	141	221
6/19	13636	9357	7677	12295	1925	158	217
6/20	13644	9358	7681	11865	20005	229	222
6/21	13628	9365	7681	11726	1926	375	230
6/22	13637	9366	7681	11042	2261	364	183
6/23	13640	9367	7681	10903	2261	392	178
6/24	13649	9369	7681	10843	1899	106	218
6/25	13564	9349	7714	11731	1848	129	199
6/26	13445	9332	7716	11106	1820	114	205
6/27	13465	9338	7716	10629	1745	229	191
6/28	13493	9341	7716	10740	1786	230	224
6/29	13499	9346	7716	10641	2152	85	166
6/30	13499	9347	7716	10618	2155	77	160
7/1	13518	9348	7716	10614	1754	152	221
7/2	13523	9350	7714	11582	1840	56	198
7/3	13532	9353	7714	11445	1873	168	235
7/4	13558	9349	7714	11901	1797	228	251
7/5	13571	9346	7714	11902	1824	125	277
7/6	13575	9347	7714	12203	2182	128	247
7/7	13575	9348	7714	12161	2185	212	245
7/8	13592	9351	7714	12148	1792	179	279
7/9	13613	9357	7714	14667	1833	275	321

a: Buyers: 13, Contractees: 7, E-Invoice Core members: 162, Bidders: 6
b: E-Invoice core members in Buyer side: 84, E-Invoice core members in Seller side: 78
c: Formosa Technologies Corp. (FTC) open website in Chinese http://www.e-fpg.com.tw

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